

Twisted Pair cables

Twisted pair cable is special type cabling that is used in telephone communication and Ethernet network. This cable is made with two separate insulated copper wires, which are twisted together with each other as well as run in parallel form.

- Twisted Pair cables are used in telephone lines to provide data and voice channels.
- Local Area Networks (LAN) also make use of twisted pair cables.
- They can be used for both analog and digital transmission.
- RJ-45 is a very common application of twisted pair cables.

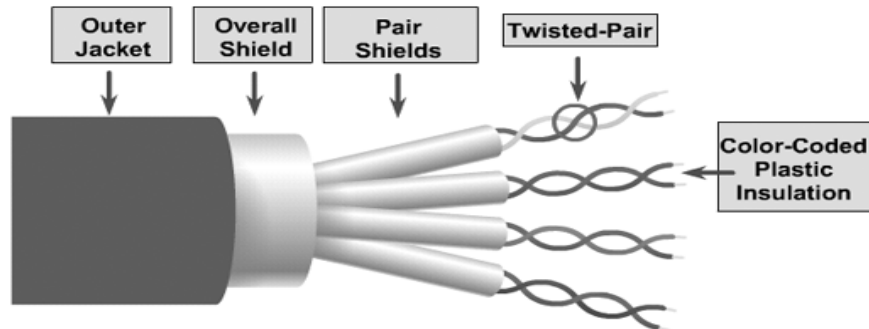
- The wires in each pair of a twisted pair cable are twisted around each other to improve electromagnetic compatibility.

Advantages of twisted pair cables

1. They are less expensive than coaxial cables
2. They are thinner than coaxial cables
3. They can be easily installed
4. They can provide high transmission rates over computer LANs and Ethernets

Twisted Pair Cables are two types :

1. Unshielded Twisted Pair Cables (UTP) :
2. Shielded Twisted Pair Cables (STP) :



STP (shielded twisted Pair).

Extra shield, foil

Connector:- RJ45 → 8 Wire with 4 pair.
↑
"Registered Jacket"

* Twisted Pair Cable 2 Categories.

EIA (Electronic Industrial Association).

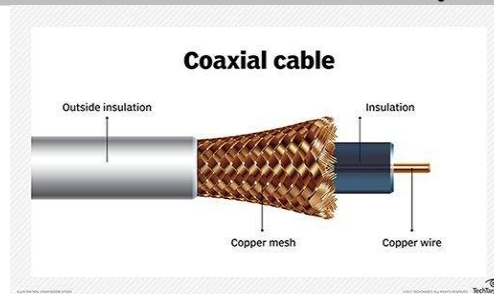
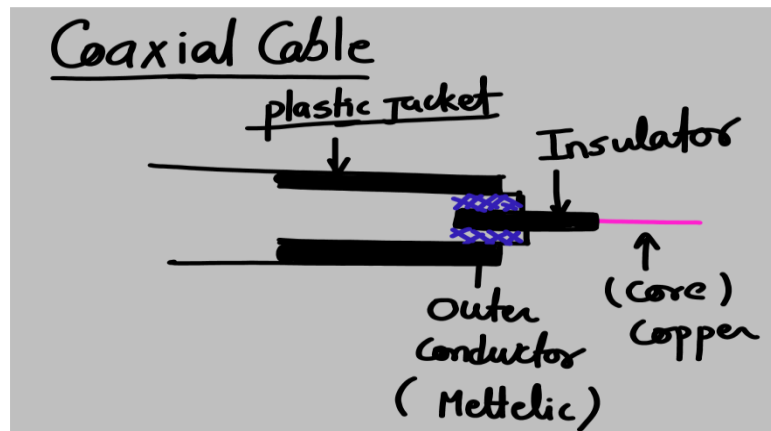
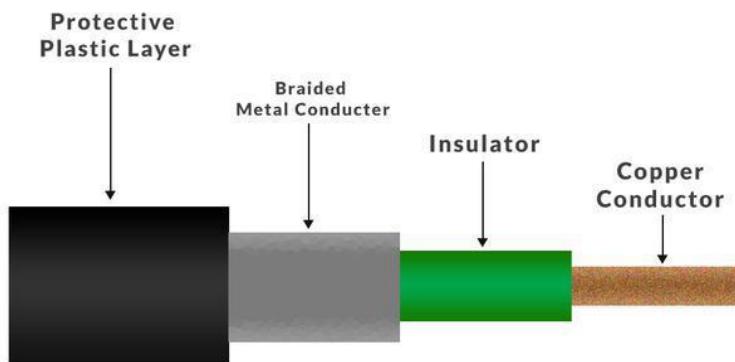
UTP Categories - Copper Cable				
UTP Category	Data Rate	Max. Length	Cable Type	Application
CAT1	Up to 1Mbps	-	Twisted Pair	Old Telephone Cable
CAT2	Up to 4Mbps	-	Twisted Pair	Token Ring Networks
CAT3	Up to 10Mbps	100m	Twisted Pair	Token Ring & 10BASE-T Ethernet
CAT4	Up to 16Mbps	100m	Twisted Pair	Token Ring Networks
CAT5	Up to 100Mbps	100m	Twisted Pair	Ethernet, FastEthernet, Token Ring
CAT5e	Up to 1 Gbps	100m	Twisted Pair	Ethernet, FastEthernet, Gigabit Ethernet
CAT6	Up to 10Gbps	100m	Twisted Pair	GigabitEthernet, 10G Ethernet (55 meters)
CAT6a	Up to 10Gbps	100m	Twisted Pair	GigabitEthernet, 10G Ethernet (55 meters)
CAT7	Up to 10Gbps	100m	Twisted Pair	GigabitEthernet, 10G Ethernet (100 meters)



Name	Frequency	Ethernet Signal Supported	Connector
Cat 5	1 - 100MHz	10/100Base T	8p8c, RJ45
Cat5e	1 - 100MHz	10/100Base T, Gigabit Ethernet	8p8c, RJ45
Cat6	1 - 250MHz	10/100Base T, Gigabit Ethernet	8p8c, RJ45
Cat6a	1 - 500MHz	10/100Base T, Gigabit Ethernet, 10Gig Ethernet	8p8c, RJ45
Cat7	1 - 600MHz	10/100Base T, Gigabit Ethernet, 10Gig Ethernet	GG45, TERA
Cat7a	1 - 1000MHz	10/100Base T, Gigabit Ethernet, 10Gig Ethernet	GG45, TERA

Coaxial Cable:

- Coaxial Cable is a type of guided media made of Plastics, and copper wires which transmit the signal in electrical form rather than light form.
- Coaxial cable is also known as coax.
- The core copper conductor is used for the transmission of signals and the insulator is used to provide insulation to the copper conductor the insulator is surrounded by a braided metal conductor which helps to prevent the interference of electrical signals and prevent cross talk.
- This entire setup is again covered with a protective plastic layer to provide extra safety to the cable.



* Cable Categories Decide According to Thickness.
(Core wire की मोटाई)

* RG (Radio Government)

75Ω RG 59 - Cable TV

50Ω RG-58 - Thin Ethernet Cable → 10 Base 2 . 25 mm

50Ω RG-11 - Thick Ethernet Cable → 10 Base 5 . 50 mm

Speed - 10 Mbps
Baseband
Distance 185 mtr

10 Mbps
500 mtr

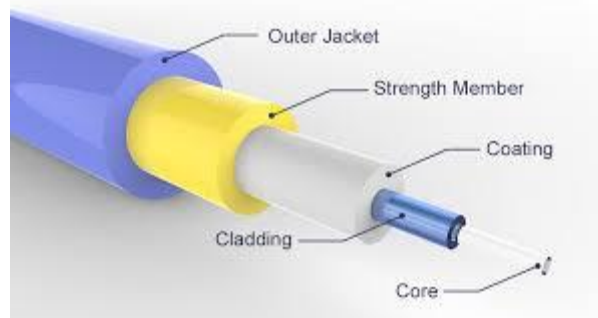
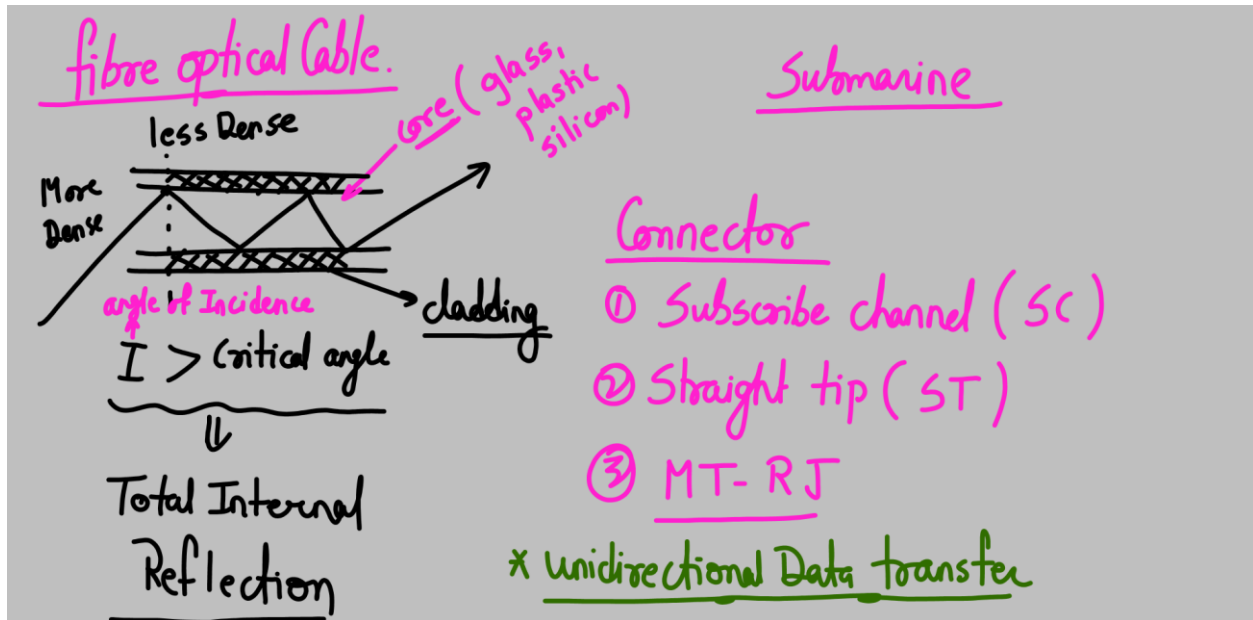
Connector - BNC (Boynet Neill Concelman).

BNC Connector
BNC T
BNC Terminator.

Application -
① Cable TV Network → RG 59
② Ethernet LAN Network -
10 Base 2
10 Base 5
③ CCTV Camera. - RG 59.

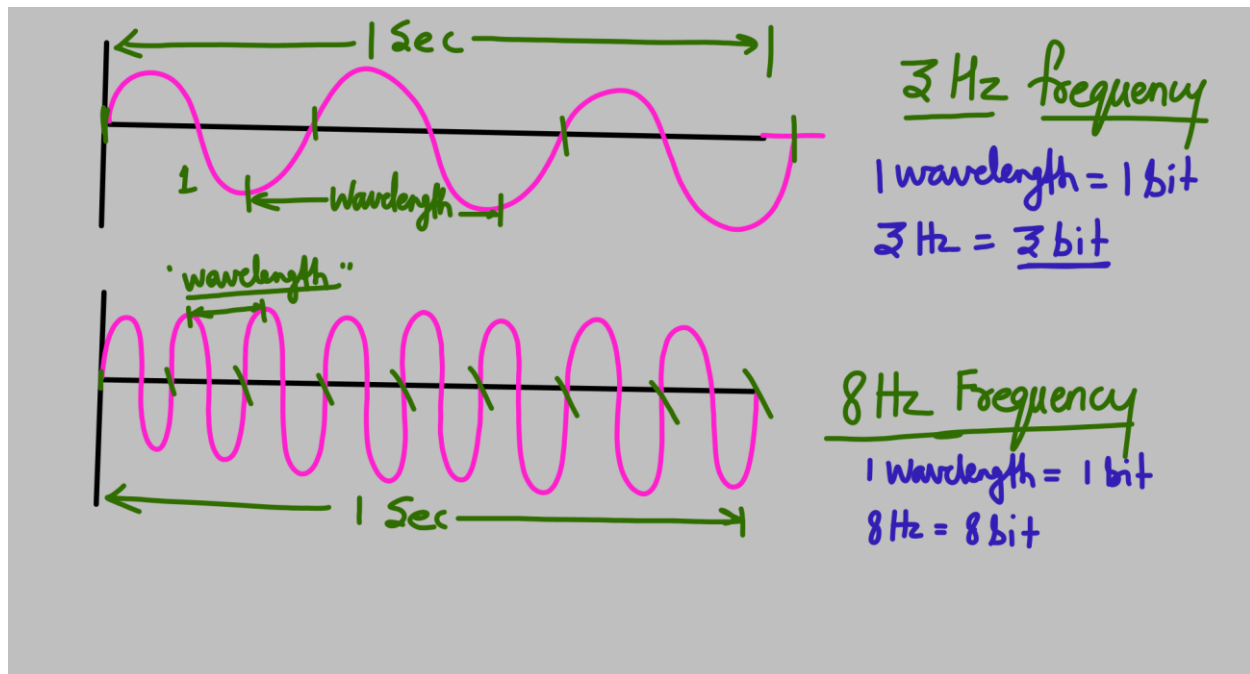
Fiber optical cable

- Fiber optics refers to the technology and method of transmitting data as light pulses along a glass or plastic strand or fiber.
- Fiber optic cables are used for long-distance and high-performance data networking.
- They are capable of transmitting data over longer distances and at higher bandwidths (data rates) than electrical cables.
- They can be used underwater. (submarine cable)
- Data transfer is unidirectional.



Frequency

The frequency is the number of times a signal makes a complete cycle within a given time frame.



Radio Waves

Radio waves are widely used for long-range communication and they operate in the range of 3 KHz to 300 GHz.

Features of Radio Transmission

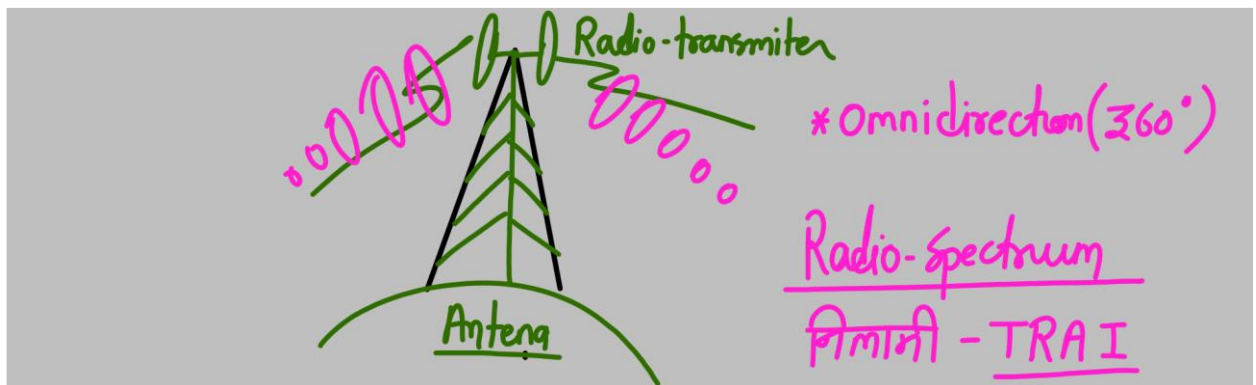
1. It can easy to generate
2. It can traverse long distances.
3. It is Omni-directional.
4. It can pass through constructing quickly, so they find considerable use in communication both indoor and outdoor.

Radio-wave :- Radio wave are Electro-magnetic wave.

Radio-wave wavelength - 1 Milli - 100 KM
(3 KHz — 300 GHz)

* Radio-wave - 3 KHz - 1 GHz

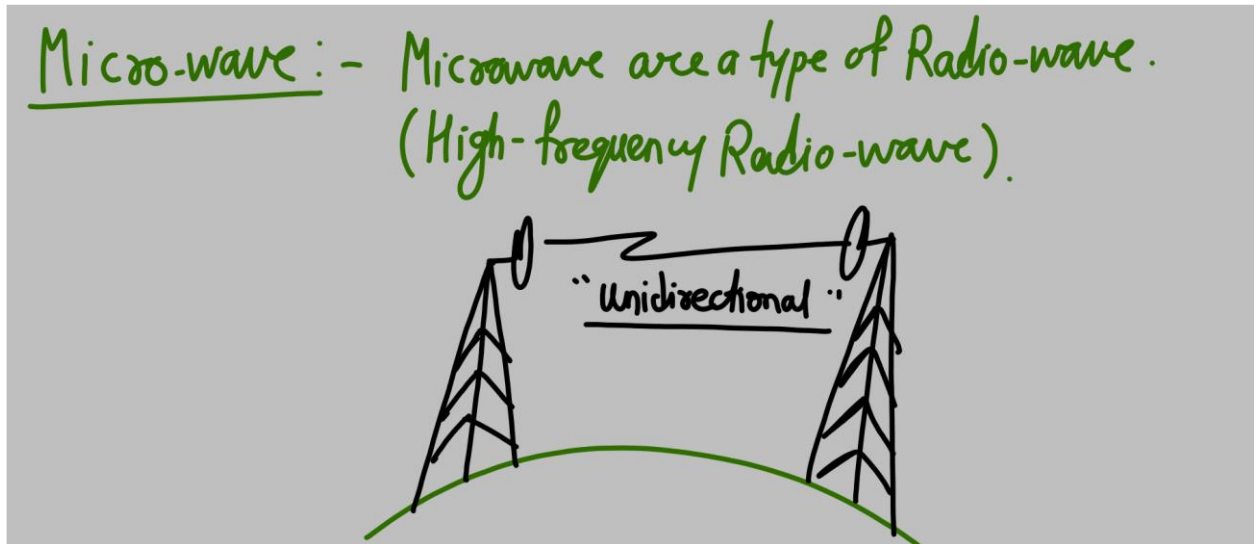
* Micro-wave - 1 GHz - 300 GHz



TRAI stands for Telecom Regulatory Authority of India. It is a government body that regulates the telecommunications industry in India.

Microwave

- data transmission, voice, and video streaming occurs via electromagnetic wave (range of frequency 1 GHz to 300 GHz) is called Microwave communication.
- This communication technique works over short to medium distances.
- it is unidirectional, it allows multiple receivers in a row to receive the signals without interference.
- Microwaves do not pass through buildings. So, indoor receivers cannot be used effectively.



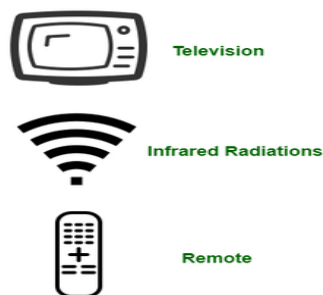
Infrared

Infrared waves are used for very short distance communication.

They cannot penetrate through obstacles.

Frequency Range: 300GHz – 400THz.

It is used in TV remotes, wireless mouse, keyboard, printer, etc.



Band	Frequency Range	Wavelength Range
Extremely Low Frequency (ELF)	<3 kHz	> 100 km
Very Low Frequency (VLF)	3 to 30 kHz	10 to 100 km
Low Frequency (LF)	30 to 300 kHz	1 m to 10 km
Medium Frequency (MF)	300 kHz to 3 MHz	100 m to 1 km
High Frequency (HF)	3 to 30 MHz	10 to 100 m
Very High Frequency (VHF)	30 to 300 MHz	1 to 10 m
Ultra High Frequency (UHF)	300 MHz to 3 GHz	10 cm to 1 m
Super High Frequency (SHF)	3 to 30 GHz	1 to 1 cm
Extremely High Frequency (EHF)	30 to 300 GHz	1 mm to 1 cm

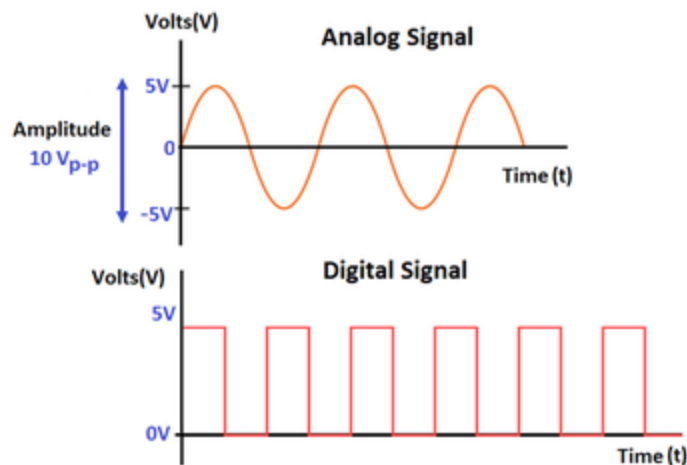
Difference Between Radio Waves, Micro Waves, and Infrared Waves

Basis	Radiowave	Microwave	Infrared wave
Direction	These are omni-directional in nature.	These are unidirectional in nature.	These are unidirectional in nature.
Penetration	At low frequency, they can penetrate through solid objects and walls but high frequency they bounce off the obstacle.	At low frequency, they can penetrate through solid objects and walls. at high frequency, they cannot penetrate.	They cannot penetrate through any solid object and walls.
Frequency range	Frequency range: 3 KHz to 1GHz.	Frequency range: 1 GHz to 300 GHz.	Frequency range: 300 GHz to 400 GHz.
Security	These offers poor security.	These offers medium security.	These offers high security.
Government License	Some frequencies in the radio-waves require government license to use these.	Some frequencies in the microwaves require government license to use these.	There is no need of government license to use these waves.
Usage Cost	Setup and usage Cost is moderate.	Setup and usage Cost is high.	Usage Cost is very less.

Basis	Radiowave	Microwave	Infrared wave
Communication	These are used in long distance communication.	These are used in long distance communication.	These are not used in long distance communication.

Signal

- Digital signals do not produce noise. Digital computers and digital phones are some of the examples of digital signals.
- A human voice, analog phones, and thermometer are some of the examples of analog signals.
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Difference between Analog and Digital Signal	
Analog Signals	Digital Signals
Continuous signals	Discrete signals
Represented by sine waves	Represented by square waves
Human voice, natural sound, analog electronic devices are a few examples	Computers, optical drives, and other electronic devices
Continuous range of values	Discontinuous values
Records sound waves as they are	Converts into a binary waveform
Only used in analog devices	Suited for digital electronics like computers, mobiles and more

